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Micro-founded measurement of regional competitiveness in Europe

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Abstract

Enhancing competitiveness is a popular target in economic policy making – not only at the national, but at the regional level as well despite neither generally accepted definition nor any strong agreement on how to measure it. In this chapter we discuss the conceptual underpinnings of why it is interesting to unpack the economic performance of a country into the economic performance of its regions. We argue that as firms compete; measuring regional competitiveness should be also based on comparing firm performance across EU regions. Given available data, we propose a new way to gauge how firms fare is to look at their ability to access and penetrate world markets. The key index is export per worker from a region to non-EU destinations relative to the EU average – a 'regional competitiveness' index that captures the capacity of a region's firms to outperform the firms of the average EU region in terms of exports.

Keywords: R11, F14, R58

JEL classification: export, regional competitiveness, measurement, granularity

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Európai regionális versenyképesség vállalatalapú mérése

Békés Gábor - Gianmarco I.P. Ottaviano

Összefoglaló

A versenyképesség javítása a gazdaságpolitikai döntéshozatal népszerű célja mind országos, mind regionális szinten annak ellenére, hogy mérésével kapcsolatban nincs általánosan elfogadott szabály, de még erős egyetértés sem. Ebben a tanulmányban annak fogalmi alapjait fogjuk körüljárni, hogy miért érdekes egy ország gazdasági teljesítményét régióinak teljesítményeire szétbontva értékelni. A vállalatok versenyző magatartása alapján úgy véljük, hogy a regionális versenyképesség mérésének a vállalati teljesítmények összehasonlításán kellene alapulnia az Európai Unió régióit tekintve. A rendelkezésre álló adatok alapján egy új módszert javasolunk a vállalatok sikerességének mérésére: a világ piacaihoz való hozzáférésük és az azokra történő belépésük képességét. A kulcsmutató az egy dolgozóra jutó, adott régióból a nem EU tag partnerek felé irányuló export az EU átlaghoz viszonyítva – egy ’regionális versenyképességi’ index, amely megragadja azt a képességet, hogy egy régió vállalatai az átlagos EU régió vállalatait export terén felülmúlják.

Tárgyszavak: export, regionális versenyképesség, mérés, granularitás

JEL kód: R11, F14, R58

1. INTRODUCTION

Enhancing 'competitiveness' is a popular target in economic policy making - at both the national and the regional levels. International regional competitiveness recently was developed into smart, sustainable and inclusive growth objectives of the Europe 2020 policy program. While a huge amount of development funds are allocated for serving this purpose, the concept of 'competitiveness' is still a rather mysterious and often debated issue. There is neither any generally accepted definition nor any strong agreement on how to measure it. While this is true for both nations and regions, the aim of this chapter is to discuss how some progress could be made at the regional level.

The regional level is important because regional diversity within the EU is substantial, and regional disparities matter at the national level in a context where GDP per capita differences across regions within EU countries are comparable to the differences observed between more and less developed EU countries. For instance, while Romania has a per capita GDP that is 32% of the per capita GDP of Germany (at PPP), the poorest Romanian region (North-East) has a per capita GDP that is just 26% of the per capita GDP of the richest one (Bucharest). As a result of pronounced regional disparities, even within the same country, people living in poor regions have much fewer work opportunities and, as long as local services are financed by local governments through local taxation, also much less access to education and healthcare. This is why measuring 'regional competitiveness' as a driver of regional economic performance has been considered an objective worth pursuing.

In this chapter we will do three things. First, in Section 2 we will discuss the conceptual underpinnings of why it is interesting to unpack the economic performance of a country into the economic performance of its regions. In particular, based on the academic literature, we will discuss how 'proximity' matters in the sense that several key interactions between people and firms that are at the core of economic performance peeter out very rapidly as distance increases, making the local context the scale at which most of the action takes place. On the other hand, we will argue that, once the local context is targeted, the economy becomes extremely 'granular' in the sense that local economic performance even more than national performance ends up being driven by the fortunes of a handful of firms that are large (at least relative to the local context). In other words, it is the importance of 'proximity' that makes 'granularity' more salient.

Second, in Section 3 we will explore the implications of 'proximity' and 'granularity' for how one may want to think of and measure 'regional competitiveness'. The basic idea is that, if 'proximity' makes the regional dimension crucial and 'granularity' implies that few large firms determine regional destinies, a natural way to assess regional performance is to look at how large firms fare across regions. We will then argue that, given available data, an effective way to gauge how large firms fare is to look at their ability to access and penetrate world markets. In this respect, we will propose a pragmatical definition of 'regional competitiveness'. This type of firms typically account for dominant shares of employment, sales and profits. They are more capital intensive and pay higher wages. They invest more in capital and human resources. They are the main actors in innovation. Our approach is practical because it measures 'regional competitiveness' in terms of actual rather than potential outcomes, and focuses on an outcome variable that is correlated but more easily measurable that several other obvious outcome variable.

Third, in Section 4 we will discuss the data needed to compute our proposed measure of 'regional competitivenes', whether they are currently available for EU regions and how their availability could be improved. We note here that the administrative definition of 'region' does not necessarily coincide with the relevant definition based on the intensity of actual interactions between people and firms. This is an old issue with a long tradition on which we have little to add, apart from stressing that data are typically collected according to the administrative definition and this is the definition that matters most in terms of regional policies.

While Section 5 will draw conclusions, two preliminary caveats are in order. On the one hand, as the ideal data are not available, this chapter should be taken as a methodological contribution to the policy debate on 'regional competitiveness' rather than an attempt to precisely measure 'regional competitiveness'. Accordingly, we will use the available data to provide specific examples rather an overall assessment of 'regional competitiveness' across the EU. Moroever, due to their limited purpose our examples will take stapshots of the situation at any point in time on statics, leaving aside the question of how patterns evolve through time. On the other hand, we do not take any stance on the relation between 'regional competitiveness' and 'regional convergence' in economic performance. One may want (all) regions to be 'competitive' because one wants them to compete. In this perspective, competition among regions may be considered good in itself. However, competition is a dynamic process and one should not expect necessarily a balanced distribution of economic activities at any point in time. Due to the pull of 'proximity', one may even expect some degree of (sound) regional imbalances at all points in time.

To our knowledge, the closest research to ours is Konings and Marcolin (2011) who uses firm level data to access the competitiveness of Belgian and German regions. In line with our work, the concept authors use does not "engage in measuring different potential drivers of productivity (with the risk of omitting some), but will directly capture the productivity level of firms that are active in a particular region." Similarly, they note the importance of large firms, arguing that by using firm level data they are "also able to analyze the dependence of regions on a few large firms, which reveals potential vulnerability in terms of relocation threats”. The data are derived from EU company accounts of the Amadeus dataset by Bureau Van Dijk (BvD) for 2005 and 2008 for medium and large sized companies. Authors compute labor productivity (value added per worker), take the ratio of the average labor cost and the average labor productivity, a measure a relative cost of a unit produced – the preferred measure of competitiveness. Our method is an alternative that focuses even more on the “outcome” of competition, but is, nevertheless, likely to be correlated with the Konings and Marcolin measure.

2. NEW FOUNDATION FOR REGIONAL POLICIES: PERFORMANCE OF REGIONS IS DRIVEN BY LOCALIZED EXTERNALITIES AND GRANULARITY

Why it is interesting to unpack the economic performance of a country into the economic performance of its regions? The answer has to do with the concepts of ‘proximity’ and ‘granularity’.

2.1 PROXIMITY

Firms compete not only through their internal capabilities, resources and business networks, but also thorough the business environments they come from. Institutions, regulations, demand conditions and many other factors of their countries of origin determine the quality and the availability of their inputs (from labor to intermediate goods and services) as well as their sales opportunities. As suggested by a long line of academic and business consultancy studies, national determinants are essential.

However, several key interactions between people and firms that are at the core of economic performance are effective at a smaller scale than the country level. These processes include labor market interactions, knowledge spillovers, trade transactions between collaborating firms and even mutual trust. The fact that some important economic interactions are constrained by proximity is one of the reasons why the concept of ‘regional competitiveness’ may be worth exploring. Indeed, even within a country regions can offer rather varied business environments, including variation in labor force quality, in agglomeration and diversity of firms, in research and development infrastructure, in urban services.

Agglomeration forces

Concentration of economic activity in some regions within a country, or in some cities within a region, has been identified as a key driver of economic performance.

Firms agglomerate to benefit from 'Marshallian externalities' enjoyed at proximity of each other as well as to save on transaction costs when working together in supply chains or in networks of knowledge and innovation. This is argued, for example, by models of the so-caled 'new economic geography' (see, e.g., Fujita, Krugman and Venables 1999 or Baldwin, Forslid, Martin, Ottaviano and Robert-Nicoud 2003) as well as by models of regional growth with knowledge spillovers (Ciccone and Hall 1996). These models suggest that interactions between people and forms with positive value larger than that signalled by market prices ('positive externalities') can arise through several channels, such as sharing indivisible goods, saving on matching costs of workers with firms and learning from each other (Duranton and Puga 2004). When 'positive externalities' require people and firms to be close to each other, they generate 'agglomeration forces' leading to the geographical co-location of economic activities. At the same time, competition between co-localized people and firms for locally scarse resources generates 'dispersion forces' that cut into the benefits of agglomeration.

In the models of 'new economic geography', proximity has several major implications. First, when firms co-locate, they offer more job opportunities and hence attract people as well. This increases the size of the local market and reduces the need to import final goods from elsewhere, thus, reduces the average transport cost embedded in the consumption bundle of local residents. Second, proximity entails also cheaper transport between firms, as the producers of intermediate goods are located closer to their end users. Third, the 'total factor productivity' (TFP) of firms (i.e. their efficiency in using given amounts of inputs to produce output) may also increase thanks to knowledge spillovers from other producers. As long as all these effects entail some degree of 'externality', the impact of proximity on income will be more than proportional to the number of co-located firms.

A fourth implication is related to labor productivity in larger and denser areas, particularly in cities (Puga 2010). This greater efficiency of labor may be partially explained by productivity gains at the firm level translated into gains of marginal labor productivity but also by 'spatial sorting' as richer job opportunities where firms co-locate are disproportionately seized by more talented people. Indeed several studies find that about half of the earning surplus achieved in denser areas come from spatial sorting. On the other hand, there are some aspects of larger and denser urban areas that are conducive to learning and personal improvement fostered by peer pressure, more valuable experience and easier access to a variety of educational services.

Agglomeration and dispersion forces are in practice quite hard to disentangle. However, their combined effect on labor productivity can be estimated and has been found to be positive. For example, Ciccone and Hall (1996) and Ciccone (2002) find that the elasticity of labor productivity to people's density is 6 and 5 percent on average in the US and EU respectively. These early findings are in the ball park of recent estimates for European countries that control for firm selection and the exogenous attributes of different urban areas (Duranton et al 2012).

Circular or cumulative causation à la Myrdal, between agglomeration and innovation, is stressed by models of regional growth that add to the 'new economic geography' perspective a dynamic dimension in terms of endogenous growth spurred by technological progress and localized knowledge spillovers. In this perspective innovation is key with agglomerated production and agglomerated innovation reinforcing each other. For example, in the model by Minerva and Ottaviano (2009) economic interactions between regions are affected by both the transport costs of exchanging goods and the communication costs of exchanging knowledge. When innovation takes place in a region, this generates faster growth and higher income, which in turn increases local demand and local profits. But higher profits make additional innovation more attractive. This leads to faster growth and higher so that cumulative causation between agglomeration and growth kicks in.

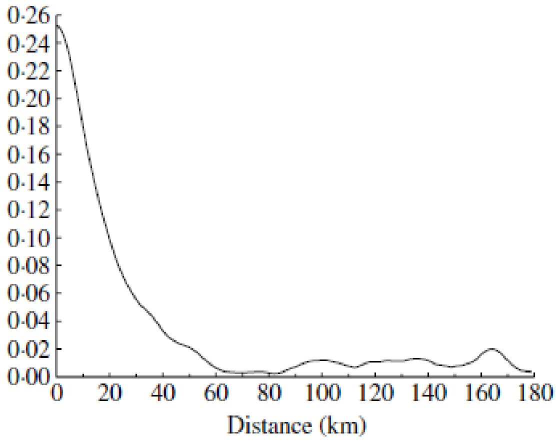
Distance decay

By now there is a large body of evidence suggesting that the impact of agglomeration decays rapidly with distance. This pattern is observed for various types of economic interactions such trade in intermediate inputs or knowledge cross-fertilization spillovers in academia or business.

Firms trade with one another by buying and selling raw materials, intermediates or capital goods ('demand and cost linkages'). To save on transport costs, they often cluster together in space, especially within industries. Duranton and Overman (2005) consider manufacturing industries in Britain and investigate the extent of co-location of firms within industries and the role of distance. They find that about half of the four-digit industries are localized and localization mostly takes place at small scales below 50 km. The graph below illustrate this pattern using the index developed by the authors.

Figure 1.

A spatial decay function for localization



Index of global localization when weighting establishments by their employment. Source: Duranton and Overman (2005 p. 1096)

Gains from proximity to other companies are localized – also when considering trade relations. For instance, Amiti and Cameron (2007) use the theoretical framework developed by Krugman, Venables and Fujita (1999) to estimate the benefits of agglomeration arising from vertical linkages between Indonesian firms using a manufacturing survey of firms at Indonesian district level. Their results show that positive externalities arising from demand and cost linkages are quantitatively important and highly localized. Strengthening cost linkages (through better access to suppliers) or demand linkages (through closer proximity to corporate customers) from the 10th to the 90th percentile raises wages and thus labor productivity by more than 20%. These productivity gains are, however, highly localized spreading over only a short distance: 90% of the spillover is observed at the firm's close proximity (within 108km for proximity to customers and within 262km for proximity to suppliers). If all Indonesian districts were 20% closer to each other, the resulting improved supplier access and market access would lead to an average increase in wages of 1.7%, and 2.9%, respectively.

Spatial concentration enhances productivity and drives wages higher – but only in proximity to productivity shocks. Using US data Rosenthal and Strange (2008) estimate the relationship between agglomeration externalities related to human capital and workers' wages at Metropolitan Statistical Area (MSA) level with 1239 spatial units at hand. First, the spatial concentration of employment is found to be positively related to wage with the urban density premium being driven by proximity to college educated workers. Second, these effects attenuate sharply with distance: benefits of education and gains from being close to educated people fall dramatically with distance. In particular, the wage increasing effect of being close to educated people falls by 75% as the distance rises from 5 to 15 miles.

Knowledge spillovers – i.e. the transfer of scientific or practical information between companies - is a key motivation for investment support programs offered in most countries and regions. Lychagin, Pinkse, Slade and Van Reenen (2010) measure spillover from knowledge laboratories in the US. They use a measure of geographic proximity based on the distribution of firms' inventors' locations instead of their HQ addresses to better capture the flow of scientific knowledge. They find that 90% of knowledge transmission happens within a few hundred kilometers from labs, and spillovers are small or virtually nonexistent beyond 500km.

Anderson, Quigley and Wilhelmsson (2009) consider knowledge spillovers in Sweden after a policy intervention aimed at decentralizing post-secondary education throughout the country. They use annual estimates of output per worker for each of 284 local civil divisions to measure local productivity. Innovative activity is found to be related to the comprehensive records of patent awards, which also include the inventor's home address. Estimates clearly suggest that productivity gains are highly localized. The spillovers from researchers employed at old and new institutions are concentrated: roughly 40% of the cumulative gain in productivity materializes within 10 km from the old institutions and for new universities this attenuation effect is even higher.

All in all, estimates suggest that positive externalities are typically effective in a narrow radius of 5-25km for interactions between people and 50-150km for interactions between firms. Hence, proximity matters and this makes it useful to unpack the economic performance of a country into the economic performance of its regions.

2.3. GRANULARITY

In most countries, a handful of firms are responsible for a large fraction of economic activity, including export sales and foreign direct investment. [1]

Dominant firms

Gabaix (2011) estimates that the business cycle movements of the largest 100 firms in the United States explain a third of the aggregate movements in output growth. In European countries, even after disregarding firms with less than 10 employees as most datasets do, 1% of the firms produce over 75% of output or of foreign sales. These are the dominant firms that are also important for their impact on business cycles. This dominance is exacerbated at a regional level, and the more so the finer the level of spatial disaggregation. Kleinert et al (2012) show how the features of a small number of large foreign-owned firms can explain several aspects of regional business cycles in France.

[1] For details, see Gabaix (2011), di Giovanni & Levchenko (2011) or Mayer-Ottaviano(2008).

‘Granularity’ captures this idea that a few selected companies play a dominant role for regional and national economic performance. In principle, it has little to do with externalities. Firm size may follow a ‘power law’ (i.e. exhibit log-linear distribution), a property initially uncovered by Gibrat (1931) in the case of French firms.[2] More recent research by Axtell (2001) on US firms estimates a power law with exponent 1.059 ± 0.054. This is very close to 1, a special case of the power law known as Zipf’s law. In this special case the second largest firm is half the size of the largest one, the third largest firm is one-third of the largest one, and so on and so forth. This can be shown to be the result of random firm growth. If different firms grow randomly with the same expected percentage growth rate (which equals the average firm growth rate) and face the same variance in percentage grow rates, the limit distribution of firms sizes converges to Zipf’s law characterized by the presence of few dominant firms.

While other factors may concur to the emergence of few dominant firms (such as public intervention or imperfect competition), the key point is that the importance of ‘proximity’ makes the local context the scale at which most of the action takes place and, once the local context is targeted, the economy becomes extremely ‘granular’ as local economic performance even more than national performance ends up being driven by the fortunes of a handful of firms that are large (at least relative to the local context).

“Million dollar plants”

Granularity makes it natural for local leaders to commit public funds to attracting investments by large companies. This may imply particularly large sums in the case of large multinationals. Greenstone, Hornbeck and Moretti (2010) report that in 1991 BMW was handed out \$115m in grants to subsidize a new plant in Greenville-Spartanburg county in South Caroline in return for an investment creating 2000 jobs. The cost and benefit analysis hinged upon the hope of BMW creating an additional 2000 jobs and generating massive gains *within* the county. Comparing the economic performance of counties that managed to attract similarly large investments – called “million dollar plants” - with those of counties that almost managed but did not quite succeed, Greenstone, Hornbeck and Moretti (2010) are able to identify the associated gains by measuring spillovers to other businesses, wages and house prices. They find that the industry of the winning county benefitted substantially over the five years following the investment: output rose, the TFP of existing companies grew and wages increased.[3] This gains have to be weighed against the possible monopsonistic power of dominant firms with respect to local workers, local supplier and local authorities (Kleinert et al., 2012).

[2] In a similar vein, Gabaix (1999) shows that the Zipf’s law in city size distribution.

[3] Even if overall gains may in general not much subsidies spent on projects.

3. "REGIONAL COMPETITIVENESS"

We now explore the implications of 'proximity' and 'granularity' for how one may want to think of and measure 'regional competitiveness'.

'Competitiveness' is a notoriously elusive concept. In its most general definition it refers to the performance of the unit of analysis relative to some chosen benchmark. Specific definitions then differ in terms of the unit of analysis, the exact measure of performance, or the chosen benchmark.

Among the several definitions of competitiveness, two stand out as particularly relevant for the discussion of 'regional competitiveness': a macroeconomic definition that takes the country as the unit of analysis; and a microeconomic definition that focuses, instead, on the firm. The concept of 'national competitiveness' is often used in the analysis of a country's macroeconomic performance relative to its trading partners with an emphasis on the factors that help explain relative export performance. These include both more qualitative factors, such technological innovativeness, product specialization and product quality, and more quantitative factors, such as cost-effectiveness and productivity. The problem with this approach is that, even when all factors are favorable, they do not necessarily lead to more exports as they may mostly show up as exchange-rate appreciation and better terms of trade. That is why standard measures of national competitiveness rely on a more restricted notion of relative performance related to international cost or price differentials .[4] This is the logic underpinning the dominant use of the Real Effective Exchange Rate (REER) -- with the underlying relative price and cost indicators -- to measure a country's national competitiveness.[5]

The use of the term 'competitiveness' to refer to relative national trade performance has been heavily criticized by economists.[6] The reason is twofold. First, it gives the impression that trade performance is an objective worth pursuing *per se* at the national level whereas the trade balance should be viewed as only a channel through which a country can borrow from or lend to other countries. And whether borrowing or lending are good or bad cannot be assessed in absolute terms but rather depends on the return on investment. Second, it suggests that factors, such as technological innovativeness, product specialization, product quality, cost-effectiveness and productivity, have some value only because they help the country gain international market shares, whereas they should be considered as important *per se* as, even in autarky, they would affect the national living standards.

4 Riley (2012)
5 http://www.bis.org/publ/econ39.htm; https://www.ecb.europa.eu/stats/exchange/hci/html/index.en.html
6 See, e.g., Krugman (???)

A reason for this confusion between ends and means arguably lies in the application to the analysis of country performance of notions first developed to describe firm performance. From this microeconomic point of view, competitiveness refers to the fact that a firm outperforms its 'competitors' in terms of size (employment, output, revenue) and profitability thanks to everything that affects the perceived quality of the firm's products and its cost-effectiveness in supplying them. When benchmark competitors consist of all firms in the same sector *producing* in the same place, a firm's competitiveness boils down to its own ability to generate more added value from any given amount of inputs, i.e. from its measured 'total factor productivity' (TFP). When benchmark competitors consist, instead, of all firms in the same sector *selling* in the same place, a firm's competitiveness is a nexus of its measured TFP and all the external factors that determine the quality- cost effectiveness of the place where the firm supplies from. These external factors link the microeconomic and the macroeconomic dimensions of competitiveness (with the caveat that what is good for the firm is not necessarily good for the place where the firm operates, and vice versa).

The distinction between the macroeconomic and microeconomic definitions of competitiveness percolates to the regional level. However, when it comes to 'regional competitiveness', the notion of competitiveness as a relative performance outcome driven by a given set of factors is often lost. For example, underlying the 'Regional Competitiveness Index' (RCI) of the European Commission there seems to be a notion of competitiveness as a *process* with its own inputs and outputs. Specifically:

> "the index is based on eleven pillars describing both inputs and outputs of territorial competitiveness, grouped into three sets describing basic, efficiency and innovative factors of competitiveness. The basic pillars represent the basic drivers of all economies. They include (1) Quality of Institutions, (2) Macro-economic Stability, (3) Infrastructure, (4) Health and the (5) Quality of Primary and Secondary Education. These pillars are most important for less developed regions.
> The efficiency pillars are (6) Higher Education and Lifelong Learning (7) Labour Market Efficiency and (8) Market Size. The innovation pillars, which are particularly important for the most advanced regional economies, include (9) Technological Readiness, (10) Business Sophistication and (11) Innovation. This group plays a more important role for intermediate and especially for highly developed regions. Overall, the RCI framework is designed to capture short- as well as long-term capabilities of the regions"[7]

This notion of 'regional competitiveness' as a process drifts away from both the macroeconomic and the microeconomic definitions of competitiveness. Bundling outputs and inputs of the process together as 'pillars' creates a taxonomy that may be useful to someway rank regions on a set of more or less reasonable criteria but transforms the concept of competitiveness into some magic black box of limited practical use.

Based on the macroeconomic and microeconomic traditions, we want to peddle, instead, the idea that the most useful way to think about 'regional competitiveness' is in terms of a

[7] http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/6th_report/rci_2013_report_final.pdf

measurable relative outcome driven by measurable factors. And that the only meaningful outcome that can be called 'competitiveness' of a region is the performance of its firms relative to their competitors in benchmark regions.

The focus on firm performance has several advantages. First, while it is true that what is good performance for a region's firms is not necessarily good performance for its people, in practice the two are highly correlated. Second, 'competitiveness' may be a disputed concept in the case of places, but it is a generally accepted concept in the case of firms. Third, when it comes to regional policy, a lot of 'competition' among regions is about attracting 'competitive firms' as these hire more workers, offer better job security, pay higher wages, invest more (also in human resources), generate more revenues and profits, and therefore allow regions to raise more tax revenues for any given tax rate.

The fact that 'competitive firms' are better along several dimension raises the thorny question of which measure of performance should be used to identify them. Recent developments in the academic literature on international trade come to rescue. These developments show that all measures of firm performance are driven by firm TFP.[8] They also show that the best proxy of exceptional TFP for a firm is its export participation and intensity: whether or not the firm is an exporter, and how much it exports. Hence, export becomes a crucial indicator of 'competitiveness'.[9] This bridges the macroeconomic and microeconomic views on 'competitiveness', and has the additional advantage of avoiding the direct estimation of firm TFP, which often requires unachievable standards in terms of data availability and still faces some open methodological issues.[10] Data on European firms indeed reveal a positive correlation at the firm level between TFP and export share of revenues.

Specifically, consider the export activities of firms located in different EU regions and active in some sector s. Consider a EU origin region o and a non-EU export destination d that is far enough from Europe and without former colonial, cultural or language links with any EU country to be equally 'accessible' from all EU regions (e.g. China). Let $L_{o,s}$ denote employment by sector s in region o and $X_{o,s}$ denote exports of sector s from region o to destination d. Analogously, let L_s denote total EU employment in sector s and X_s denote total EU exports to d in sector s. Then compute the share of region o in total EU exports normalized by the share of region o in total EU employment in the sector. We take the resulting 'normalized export share'

[8] See, e.g., Mayer and Ottaviano (2007)

[9] Firms that not only export but are also directly investing abroad (FDI) are even more exceptional. Indeed, 'internationalization' in general (i.e. selling to customers on a global market) is what we have in mind. However, we prefer to focus on exports as data are more easily available. Considering also FDI would increase the importance of the top 5% of firms.

[10] See, e.g., Bartelsman et al (2013)

$$NXS_{o,s} = \left(\frac{X_{o,s}}{X_s}\right) \Big/ \left(\frac{L_{o,s}}{L_s}\right)$$

as our measure of the 'regional competitiveness' of region *o* in sector *s*. This can be rewritten as

$$NXS_{o,s} = \left(\frac{X_{o,s}}{L_{o,s}}\right) \Big/ \left(\frac{X_s}{L_s}\right)$$

which is export per worker from region *o* to destination *d* relative to the EU average. Hence, our 'regional competitiveness' captures the capacity of a region's firms to outperform the firms of the average EU region in terms of exports. It is worth stressing that this does not imply that we see export as good in itself but rather the reason why we focus on export is that it is a strong indicator of the TFP of firms in the region.

According to the academic literature on which this argument is based, export proxies exceptional firm productivity because firms have to be very productive in order to generate the revenues needed to cover the additional costs they face in serving foreign markets. Some of these costs are due to the fixed initial investment required in breaking into a market (such as the costs of creating a distribution network), others are recurrent and vary with the amounts shipped (such as transport costs and tariff barriers). Fixed export costs affect the number of producers that are able to export ('extensive margin'); variable export cost affect the amount of shipments per exporter ('intensive margin').

To capture these two dimensions, we denote the numbers of exporters and producers in region o (in the EU) by no,s (ns) and No,s (Ns) respectively. This allows us to decompose the normalized export share into two multiplicative components as

$$NXS_{o,s} = \left(\frac{n_{o,s}x_{o,s}}{N_{o,s}l_{o,s}}\right) \Big/ \left(\frac{n_s x_s}{n_s l_s}\right) = \left[\left(\frac{n_{o,s}}{N_{o,s}}\right) \Big/ \left(\frac{n_s}{N_s}\right)\right] \times \left[\left(\frac{x_{o,s}}{l_{o,s}}\right) \Big/ \left(\frac{x_s}{l_s}\right)\right]$$

where $x_{o,s}$ (x_s) denotes average export per *exporter* and $l_{o,s}$ (l_s) denotes average employment per producer in region *o* (in the EU) respectively. We then use the 'extensive' and the 'intensive' normalized export shares

$$NXS^{e}_{o,s} = \left(\frac{n_{o,s}}{N_{o,s}}\right) \Big/ \left(\frac{n_s}{N_s}\right)$$

$$NXS^{i}_{o,s} = \left(\frac{x_{o,s}}{l_{o,s}}\right) \Big/ \left(\frac{x_s}{l_s}\right)$$

to measure region *o*'s 'extensive regional competitiveness' and 'intensive regional competitiveness' in sector *s*. These capture the extent to which regional competitiveness is affected by fixed vs. variable export costs. In particular, the importance of the extensive margin suggests that firms have to be productive enough in order to break into the export market. This implies that regional competitive is driven not only by the TFP of the average firm (which affects the extensive margin) but also by the fraction of local firms whose TFP is high enough to overcome the fixed cost of export. Hence, our measure of regional competitiveness puts a premium on the concentration of firms in the upper tail of the TFP distribution ('granularity'). [11] As these are the firms that hire more workers, offer better job security, pay higher wages, invest more (also in human resources), and generate more revenues and profits, this premium is not unwarranted.[12]

A final caveat is in order. Our notion of regional competitiveness is sectoral in nature, the idea being that it does not makes much sense to try to gauge the relative performance of two regions by comparing the productivity of firms that operate in different sectors. Yet, the inter-sectoral perspective may also be important from a risk sharing point of view: is it better for a region to be very competitive in fewer sectors or someway less competitive in a larger number of sectors? The answer depends on how risk is shared with other regions through labor and capital mobility or redistributive policies. This, however, shifts the focus from regional to national competitiveness and goes beyond the scope of our analysis.

4. MEASUREMENT ISSUES

4.1 IDEAL DATA

In this section, we contrast our first best approach to data reality. We start by describing how an ideal dataset – building on existing but not easily accessible data – looks like, followed by a discussion of major issues and challenges. We acknowledge that while the data we need do exist, access to data is very difficult in most countries, and coming up with a harmonized, distributed data approach is hard.

For any given year, the competitiveness index for a region *o* and industry sector *s* is created in several steps. The data need is quite extensive. First, we need firm level balance sheet data with information regarding the number of employees, industry classification. This data is available for almost all EU countries but often with limitations. It is missing for Croatia, for Czech Republic, Slovakia, Poland firms are only surveyed beyond a size limit (typically 10-50).

Second, we need information about the location of the firm, at least at some regional level. For several countries, a NUTS2 or NUTS3 code is directly available. In other countries, the city or the ZIP code of HQ is available in addition to financial data, although it sometimes

[11] See Barba Navaretti et al (2014) for a discussion of the importance of higher moments of the productivity distribution in explaining aggregate export performance. Duranton et al (2012) discuss how these moments are shaped by agglomeration economies.

[12] See, e.g., Gabaix (2013) for a discussion of the role of large firms for the economic activity at the national level. Large firms are even more important at the regional level as implied by the notion of 'balls and bins' put forth by Armenter and Koren (2014).

require merging data from corporate registry. Third, we need firm level dataset matched with customs data with detailed information about exports, including destination countries, and ideally, products as well. Customs data is more and more available in Europe.

Provided that all data would be available the key task is to decide upon aggregation details. Based on availability information[13], considering NUTS2 regions, 2 digit NACE revision 2 industry classification should work for almost all countries. We present an example of the procedure using Hungarian data in the Appendix of this chapter.

Another option would be to use private/survey data as in Konings and Marcolin (2011). The advantage of such dataset is availability for many countries. At the same time, in lack of trade data, it can only use balance sheet information that is often hard to compare across countries that differ substantially in accounting and reporting standards.

4.2 DATA PROBLEMS AND CHALLENGES

A. Regional definitions

Before turning to data issues to generate our preferred variable, we should acknowledge that the administrative definition of region does not necessarily coincide with the relevant definition based on interactions. A key area of study in economic geography is the modifiable area unit problem, the notion that aggregation by different scope and different boundaries may yield different outcome. In particular the size of regions seems to be an important driver of some measured elasticities[14].

Another aspect, recognized by the EU in its competitiveness report by Annoni P. and Dijkstra L. (2013 p5) is related to accounting employment in the case of large cities. This is not a problem for Paris (as Ile-de-France includes commuters), but it is for London, which is actually cut into two NUTS2 regions. The problem is particularly important for also for Brussels, Prague, Berlin, Amsterdam and Vienna. Annoni P. and Dijkstra L. (2013) detail several other regional boundary related issues.

Given data requirements, this is not a real issue for us, NUTS2 seems the realistic area of study. Looking at evidence from MAPCOMPETE, we know that data are typically collected according to the administrative definition, at NUTS2 or NUTS3 level. It is only at a few countries, such as France or Hungary, where data may be actually linked to corporate registry with information on the municipality the firm is located.

[13] See Chapter 2 of Castellani and Koch (2015) as well as http://mapcompete.eu/meta-webtool

[14] See Briant et al (2012) and Békés and Harasztosi (2015)

One potential solution may starting with NUTS2 level, but considering some additional regional aggregation.

B. Narrow industries, small regions

Calculating this index faces a challenge specific to the use of anonymized data: data providers retain the right to suppress observations to prevent external identification of corporate data. In particular, calculating values at regional and sectoral level often face secrecy problems by the data providers. One typical barrier to computation of each region-sector cell is a minimum requirement of firm count: each cell has to be made up of at least a few firms (3-6 depending on countries). This may be an issue when industries are narrowly defined or regions are small. At this stage we believe this not a major issue, but may matter for small regions and small industries – requiring sectoral aggregation.

C. Extreme granularity– top firm accounting

The next problem is more important as it goes to the core of our exercise. Data providers also suppress cells when one firm is too important (for example, its sales represent more than 70% of total sales of firms in that cell). As a result, when the sector-region cell includes the top firm in that sector, the cell result may be suppressed even if there are other firms present. Given the narrow approach, this may generate a huge bias.

These problems, may be reduced by aggregating industries (such as food and beverage) or aggregating regions. This is a key reason for choosing NUTS2 as more realistic level as opposed to NUTS3[15]. However, large firm problem may prevail, and there is no easy fix, it may only be solved by co-operation between NSIs and Eurostat.

Beyond issues relevant to this index, the main hindrance in calculating our preferred index is access to data. As argued in the book by), data availability is typically excellent to good in EU countries, but accessibility is often rather difficult. To calculate our index, one needs access to the original data or ask someone with access to run do files. However, given differences across countries, this latter approach is rather cumbersome. Furthermore, in several countries, in France and Germany, for instance, there are legal barriers to get access.

As a result, the only possible way to calculate these indices would be to get Eurostat coordinate a project with scientific involvement, whereby national statistical offices calculate values based on a common and harmonized approach.

[15] To see NUTS3 level data, one should aggregate sectors into a handful of macro sectors.

D. Firms: observation and reality – from establishments to value chains

The typical unit of observation is legal entities. As a result, there plenty of other measurement problems. Almost all datasets would not pertain information about business groups, within which transfers may bias a great deal of estimates – a major issue in services. Observation of establishments that may do production away from HQ may also be a problem, even if the most frequent case is that production does not take place far away from production. While in several EU countries, there are plans to improve data quality, there is not much we can do at this stage.

Another measurement problem is a consequence of multinational groups. Exports to non-EU countries are collected and assembled by national and EU institutions. Ideally, the final destination is measured. However, multinational companies exercise a great freedom in terms of organizing in which country authorities actually take care of customs and procedure. Hence, a multinational company's Czech affiliate may export to China, but it will not be picked up as the company may concentrate its customs activity in, say, the Netherlands. Once again, there is very little we can do other than acknowledge that our measure is likely to be biased to regions that are more specialized in global commerce.

In particular, some industries may be organized rather differently in terms of value chains, distribution networks. This may lead to countries specialized in some industries to export more or less directly to non-EU countries. Industries with flatter value chains should create less bias due to presence of distributors or specialized trading subsidiaries in some countries. For our purpose, we compare industries instead of aggregated economy, and we may disregard the wholesale sector as well.

E. Business services

Trade in services are typically not as well accounted for as in trade in goods, potentially downward biasing regions with a strong service sector. Fortunately, trade in services are included in firm level data[16]. The bad news is that measurement, pricing issues may typically be of greater importance for services than for goods trade. It is also much easier to sell services globally from the HQ – either in the big city or even from the multinational company center. This may downward bias NSX of regions that are more specialized in business services. The result of these opposing biases are unknown and may vary country by country.

[16] Included in trade data, HS6 starting with 98 and 99

5. CONCLUSION AND SUGGESTIONS

In this paper, we aimed at arguing for a new approach in thinking about regional competitiveness and offer a new measure of this.

First, we argued that there are some solid economics argument in favor of thinking in terms of regions as units. Proximity matters as agglomeration externalities influence firm performance, these externalities decay fast with regions being close to a relevant area for most spillovers, and granularity is key, as a few large firms matter regionally more than in countries. Second, we made case in favor of an outcome type measure instead of a mix of drivers. An outcome measure has the advantage of transparency and allows for future enquiry about the relationship of outcome (firm performance) and potential drivers such as infrastructure or local R&D. Third, we proposed a measure based on firms' sales in non-EU markets. This approach has the advantage of comparability across EU countries and easy calculation.

Finally, we looked at data availability and access across Europe and concluded that our index may be calculated given available data for almost all EU countries. At the same time such an exercise would require either Eurostat co-ordination, or collaboration of great many institutions. We believe that what is needed at this stage is a Eurostat coordinated effort – with potential researcher participation. One the index is calculated, future research may analyze key drivers of differences of firm performance in various regions. Co-ordination with national statistical institutions is also key to manage confidentiality issues.

Furthermore, with improved data quality, research into the importance and structure of business groups, the diversity establishment networks, or accounting practices of services trade may shed light to potential biases in measurement.

Appendix

A. Example: Hungarian regions

Before creating variables, one needs to make some choices: (i) how to best define outside markets, (ii) what regional aggregation, and (iii) what sectoral aggregation. Here, we'll experiment with two outside market options: [1]: China and [2] All countries outside Europe[17]. As for regional aggregation, NUTS2 level is necessary to get sensible industry level values. NUTS3 is only possible when using total economy aggregates – ie when we assume simple additivity of industry competitiveness values. As for industry, for most industries, 2-digit level is the maximum to get enough firms. For a few broad sectors, such as machinery, 3-digit level would be possible.

The first step uses firm-destination- product specific data, mostly available from customs. Product data are typically available at HS6 level. There are two alternatives to get industry level values when exports are given at product level. The more direct approach is to sum export sales by products and apply a product-industry conversion filter to get firm-destination-industry level export data. We suggest using 2 digit NACE rev2 industry setting. The second, easier but less precise approach is to classify a firm's all exports by the firm's primary NACE code.

For each firm-NACE, calculate $X1\_{}_{id\_nace}$: Firm-NACE-Export to China, $X2\_{}_{id\_nace}$: Firm_NACE-Export to outside Europe , $X\_{}_{id\_nace}$: Firm-NACE total export. Generate $X1S\_{}_{id}$:=sum of $X1\_{}_{id\_nace}$; $X2S\_{}_{id}$:=sum of $X2\_{}_{id\_nace}$; $XS\_{}_{id}$:=sum of $X\_{}_{id\_nace}$ [18]

The second step, is to work on firm level data to calculate, for each firm, $L\_{}_{id}$ as the number of employees and $Y\_{}_{id}$ as the total sales of firms. We can generate $L\_{}_{id\_nace} := L\_{}_{id\_} * X\_{}_{id\_nace} / XS\_{}_{id}$

In the third step, we need to merge data to have firm-nace level observations. We sum by region-sector, to get total exports to China / outside EU by industry and region and create number of firms per region-sector, number of exporting to China firms per region-sector so that we can discuss extensive and intensive margins. Finally, we create number of employment per sector-region using L_id_nace.

Table 1 presents NXS index values for NACE2 manufacturing sectors. Calculations are based on total non-Europe (EU28+) exports[19]. For instance, let us consider the food manufacturing sector (#10). The most competitive region is South-East. There we find that

[17] EU28+ Andorra, Belarus, Bosnia and Herzegovina, Iceland, Liechtenstein, Macedonia, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia,Switzerland, Ukraine, Vatican City

[18] NB: Firm id, Location at region level (NUTS2), L, Y, X1S, X2S, X3S –same for all nace. X1, X2, X3 and L varies by nace.

[19] We repeated this exercise for EU28 exports as well and found a 60% correlation. China alone cannot be determined at 2-digit industry level.

an average sized firm in that region exports to outside EU twice (216%) the Hungarian average. In other words, we do not consider the mass of firms because that would also imply specialization, but instead, we correct a mass of exports food producers by the employment at those firms. This figure is high when firms on average (i.e relative to their size) export a lot to outside of the EU.

Considering manufacturing, West and Center-West regions are the most competitive on average (weighted by employment in industries), followed by the Central region (including Budapest). As is visible from the table, there is substantial variation across regions. South-West does well in food, while North is competitive in chemicals.

Table 1.

NXS index values for Hungary

EXTRA EU	10 food	11 beverages	13 textiles	14 wearing apparel	15 leather and related	16 wood	17 paper and paper	20 chemicals	22 rubber and plastic
Central (incl Budapest)	121%	94%	56%	236%	31%	101%	89%	61%	48%
West-Center	21%	607%	77%	8%	366%	187%	299%	20%	111%
West	113%	15%	189%	4%	315%	23%	6%	34%	65%
South-West	21%	140%	93%	240%	68%	508%	10%	25%	40%
North	16%	133%	61%	2%	27%	8%	29%	281%	148%
North-Center	55%	16%	90%	5%	104%	16%	7%	217%	204%
South-East	216%	91%	160%	12%	3%	62%	13%	13%	138%
weights (SUM EMP)	86630	11458	8362	13594	11126	14989	11111	29139	35308

EXTRA EU	23 other non-metallic mineral	24 basic metals	25 fabricated metal	27 electrical equipment	28 machinery, equipment	29 motor vehicles	31 furniture	32 Other manufacturing	*weighted av*
Central (incl Budapest)	102%	191%	67%	166%	101%	21%	13%	93%	***97%***
West-Center	179%	86%	189%	89%	178%	112%	295%	248%	***134%***
West	80%	61%	233%	100%	142%	223%	143%	19%	***120%***
South-West	1%	15%	17%	64%	9%	24%	17%	8%	***49%***
North	2%	31%	64%	23%	61%	55%	9%	127%	***60%***
North-Center	23%	25%	64%	35%	44%	1%	39%	98%	***60%***
South-East	62%	10%	39%	21%	36%	21%	4%	26%	***68%***
weights (SUM EMP)	19547	16361	36792	70067	79434	57291	17858	13164	

Notes. The table shows values for NSX values for Hungary, at 2-digit NACE2 industries and NUTS2 regions. Values are calculated with only Hungarian data, ie. 100% would be the average region-sector value in Hungary. Red numbers are based on imputations due to suppressed data (too few firms or presence of very large firms)

B. Example: EFIGE results for selected EU regions

In the lack of official data, one could use private data or survey information. One possibility could be using Amadeus, the European firm level database curated by Bureau van Dijk. Data include balance sheet information including export sales. However, this information is not available for most countries.

At the same time, the survey EFIGE offers a way to compare regions in selected countries. The dataset covers 14 thousand EU manufacturing firms with at least 10 employees, located in seven countries: Germany, Italy, France, Spain, UK, Austria and Hungary. The dataset includes a great deal of information about internationalization activities of these firms[20].

The advantage of the dataset, is that for each firm, we know the share of sales exported to outside Europe, calculated by multiplying (i) the share of exports to sales and (ii) share of non-Europe exports to total exports. Unfortunately, the sample is not large enough to consider industries.

Before turning to results, please note that the EFIGE dataset does not include exports values only size of the company by labor. To partially remedy this, we merged the data with information from Amadeus on total sales revenue. As a result, we generated our preferred index for most regions in 6 countries – Amadeus sales data is very poor in the UK. Furthermore, we also generated a simplified index, available for all regions in the sample: instead of adding up export sales in euros, we weight 'normalized export share' by labor only. Hence our second measure, is a regional labor weighted average non-Europe exports to sales ratio.

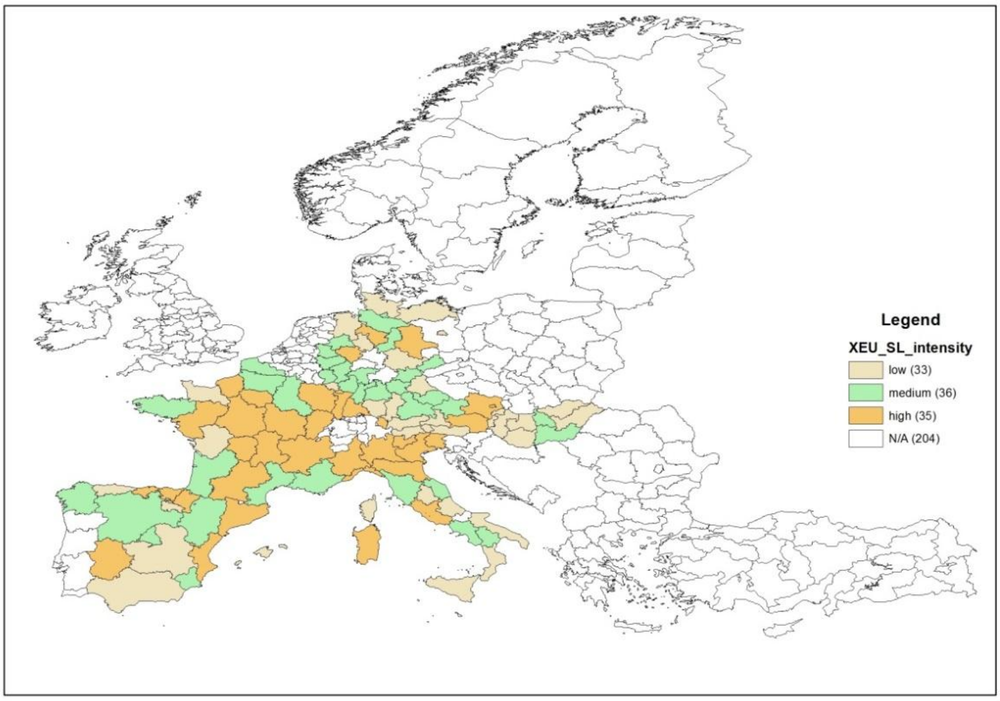
Highest index values are attained by regions in center of France, North-West of Germany, North of Italy and some regions in Austria. Low values are attached to Hungarian regions apart from the Centre, South Italy, Eastern part of Germany, East Spain. The simplified measure would put a great many UK regions on top as well.

Of course, this is just an illustration of our approach, given data weakness, actual results should be treated with great caution.

[20] For details, see. Altomonte et al. (2013)

Figure 2.

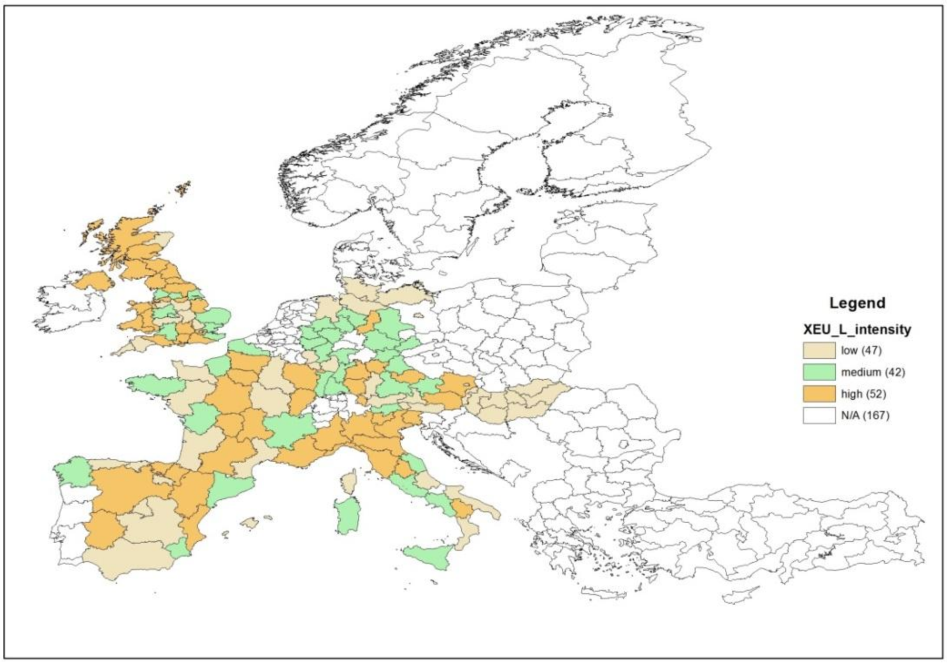
Map of NSX regional competitiveness index



Notes: Calculated using the EFIGE survey for 2009. The index is calculated for most but not regions in the sample in 6 EU countries (no UK data). Generated by weighing non-Europe export values by labor (as defined above)

Figure 3.

Map of NSX regional competitiveness index – simplified version



Notes: Calculated using the EFIGE survey for 2009. The index is calculated for all regions in the sample in 7 EU countries. Simplified version: generated only by using number of employees as weights disregarding labor productivity.

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